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PATENT SPECIFICATION

DRAWINGS ATTACHED

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1,141,661



1,141,661

Date of filing Complete Specification: 7 June, 1966.

Application Date: 10 June, 1965.

No. 24517/65.

Complete Specification Published: 29 Jan., 1969.

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Index at acceptance: —H1 R(1R, 3A, 3C1, 3H)

Int. Cl.: —H 05 k 7/18

COMPLETE SPECIFICATION

Improvements in or relating to Rack-Mounting Arrangements

5 We, AUTOMATIC TELEPHONE & ELECTRIC Co. LTD., of Strowger Works, Liverpool, 7, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 The present invention relates to rack-mounting arrangements for electrical apparatus and although it will find application in automatic telephone exchange installations it is not limited thereto.

15 In British Patent Specification No. 938,688 rack-mounting apparatus is disclosed which, amongst other things, is suitable for crossbar switch telephone exchanges of the kind described in British Patent Specification No. 890,235 and which operates according to the so-called "self steering system". These rack-mounting arrangements comprise a two-suite construction with each suite having five double-sided racks and ten equipment shelves per rack mounted in a dust-free zone. The inter-rack space, disposed to the right hand side of each rack, as viewed from the front of the suit is a cabling and wiring duct which is shared by its adjacent racks.

20 The double-sided rack frameworks are constructed from four light vertical-members of angle-sectioned steel which are joined by horizontal members, also of angle-sectioned steel, to form a box-like structure. The side walls of the vertical cabling and wiring duct are formed from two substantially W-shaped cross-sectioned sheets of steel which extend vertically in a back-to-back relationship from the lower to the upper regions of the duct. These duct side-walls also serve as side-walls to the equipment mounting area.

The opposite faces of the rack are divided into eleven spaces or positions by horizontal cross-rails, the lower position being for a fuse-panel unit, whereas the remaining ten positions accommodate standard shelf-units, for example, a cross-bar switch with its attendant control relays. Cable trunking for inter-rack and inter-suite connections is disposed above the racks and is an in-built part of the basic structure. The cable trunking is constructed mainly from steel bars and angle-sectioned steel covered by formed sheet-steel.

It will be appreciated that a rack-mounting construction of this type, although being of relatively simple design, involves many measuring operations, for instance, in respect of drillings for the location of bolts and screws for securing the numerous piece-parts to one another, which are undesirably time consuming.

It is an object of this invention to provide improved rack-mounting arrangements for electrical apparatus typically for use in telephone exchange installations, in which a marked reduction in the time-consuming operations of measuring, drilling and piece-part assembly is obtained.

According to the invention, in a rack mounting arrangement for electrical apparatus comprising a plurality of racks connected together in side-by-side relationship to form a suite, with the side walls of each rack forming an equipment mounting zone therebetween in which is located at least one equipment shelf, the inter-rack space between the side walls of adjacent racks serving as an enclosed cabling and wiring duct, the inter-rack space comprises a die-cast base to which four extruded uprights are secured

one at each corner of said base and the up-
rights are provided with a plurality of longi-
tudinal T-shaped slots in each of two oppo-
site faces thereof, the T-shaped slots in one
5 face of the uprights enabling the uprights to
be secured by means of T-bolts to securing
blocks on said base and also enabling spaced
horizontal die-cast bracing members to be
10 secured to opposite pairs of uprights to define
the front and rear of the inter-rack space
whereas the T-shaped slots in the other face
of the uprights enable other die-cast bracing
members to be secured to the other opposite
15 pairs of uprights to define the sides of the
inter-rack space, and one side each of two
adjacent racks.

The invention will be more readily under-
stood from the following description of one
method of carrying it into effect, and should
20 be read in conjunction with the accompanying
drawing:

Of the drawings:

Fig. 1 illustrates the construction of an
inter-rack space or cabling and wiring duct.

25 Fig. 2 illustrates the cabling and wiring
duct base die-casting together with arrange-
ments for securing the extruded upright mem-
bers and for the bus-bars,

30 Fig. 3 illustrates the method of attaching
the horizontal die-casting to the extruded
uprights and the W-panel section to the hori-
zontal die-casting and the extruded uprights,
an equipment area extruded cross-rail being
shown attached to the horizontal die-casting.

35 Fig. 4 illustrates the details of the lower-
door of the cabling and wiring duct and the
"kicking-strip".

40 Fig. 5 shows an end view of the "kicking-
strip" and illustrates how it is secured to the
lower cover-plates of the rack,

Fig. 6 shows the arrangements for hinging
an equipment area cover,

45 Fig. 7 shows an end-view of several ex-
truded cross-rail members and illustrates, on
the one hand how a front cover hinges, out-
wards, and on the other hand how a front
cover is fitted in position between two cross-
rail members, and

50 Figs. 8 and 9 show an alternative form of
handle for the front cover.

Referring to Fig. 1 and Fig. 2, it will
be seen that an aluminium-alloy base die-
casting 10 has an integral upstanding block
such as 11 at each corner. Each block 11 has
55 two slots such as 12 and 13 each of which
accommodates the shank of a T-bolt such as
14 shown in Fig. 3. The four aluminium-
alloy extruded uprights, 15, 16, 17 and 18
each have four longitudinal T-slots 19, 20,
60 21 and 22 (Fig. 3) for accommodating the
heads of T-bolts such as 14.

The head of a T-bolt, as viewed down the
shank, is of parallelogram form, the short
dimension being equivalent to the dimension
65 between the lips of the T-slot to enable the

head to be passed into the root of the T-
slot. When the bolt is rotated within the
T-slot in either a clockwise or anti-clockwise
direction (normally clockwise when turning
an attached nut) the head having its long
70 dimension larger than the width of the root
of the T-slot cannot fully rotate and so an
attached nut can be turned to move down
the shank on the thread. The T-bolt during
rotation, and when an attached nut has been
75 tightened, cannot be extracted from the T-
slot since the head is locked behind the lips
of the T-slot.

Referring again to Fig. 2, it is shown here
how an extruded upright 17 is secured by
two T-bolts and their associated nuts 23 and
80 24 to an integral upstanding block 11.

It will be noted that in Fig. 1 no securing
nuts, bolts or screws are shown, these having
been omitted from the drawing for the sake
85 of simplification. However, it will be appreci-
ated that the positions for these items are
shown in more detail in Fig. 2 and Fig. 3.

Referring again to Fig. 1a, the horizontal
bracing-members, such as 25, between the ex-
truded uprights 15 and 18, and 16 and 17 are
90 metal die-castings which incorporate two
bearing-housings 26 and 27. Each housing
is adapted to take the bearing-pin of a hinged
equipment-shelf frame (not shown). The
95 tapped bore such as 28 at each end of the
die-castings 25 accommodates the securing
bolt for the end of a hinge on an equipment-
shelf frame. Each die-casting, such as 25,
has a post, such as 29, which assists in sup-
100 porting the W-shaped cross-sectioned side-
walls, or W-panels 30 and 31, of the cabling
and wiring duct at its central portion. On
the uppermost die-casting between the up-
rights 16 and 17 it will be seen that the
105 post such as 29 has a boss such as 32 at its
extreme end. This boss on all posts, such
as 29, except the two uppermost in the duct,
pass through a bore in the central portion of
the W-panel and the tip is then "peened"
110 over. The die-casting, such as 25, also serves
as a cable support for the cable (not shown)
to be extended from the equipment shelf to
the tagblocks (not shown), of the type typically
disclosed in our co-pending Application No.
115 52936/64 (Serial No. 1,128,209) and which
are mounted in the cut-outs, such as 33, in the
W-panels 30 and 31. Each die-casting, such
as 25, also incorporates two brackets, such
as 34, one at each end, and each has an
120 open-ended slot 35. To each of these brackets
it attached, by means of a T-bolt, such as
14, and nut, such as 36 (Fig. 3), an equip-
ment-area extruded aluminium-alloy cross-
rail, such as 37 which has an interlocking
125 section 76 the purpose of which will be ex-
plained later. The die-casting such as 25
is secured between two extruded uprights (in
Fig. 3 uprights 15 and 18) by means of four
T-bolts, two at each end of the casting. It
130

is important to appreciate that the casting, such as 25 is pre-positioned by location ribs (not shown) which locate in the same slot as the T-slot in which T-bolts are secured. In Fig. 3 the heads of two T-bolts are located in T-slot 21 of the extruded upright 18 while the shanks pass through open-ended slots provided in the casting. The casting is clamped in position to the upright by the two nuts 38 and 39. The other end of the casting is clamped to the extruded upright 15 in a similar manner.

Referring again to Fig. 3 it will be seen how the longitudinal edges of the W-panels are attached to the extruded uprights. In the particular details shown, W-panel 30 is shown attached to extruded uprights 15 and 18. The longitudinal edges rest in a narrow longitudinal slot, such as 40, in the uprights 15 and 18 and abuts a longitudinal flange, such as 41 which is part of the upright. At suitably spaced intervals along the length of the flange, rivets, such as 42, are used to secure the W-panel to the uprights.

Other horizontal bracing members between the extruded uprights 15 and 16, and 18 and 17 are also die-castings such as 43, and these each have an open-ended slot such as 44 at each end to enable them to be secured to the extruded uprights by T-bolts and their associated nuts.

It will be noted from Fig. 1 that in the drawing a large portion from just above the lower door 45 to just below the top of the upper door 46 has been omitted for the sake of simplification. However, it should be appreciated that there are five such doors on two opposing sides of the inter-rack space, there being a horizontal bracing-member such as 43 in positions below the lower door and above the upper door as well as between all other doors.

By referring now to Fig. 4, it will be seen how the door 45 is hinged. The hinging arrangements comprise two resilient plastics-mouldings, such as 47, secured at the rear of the door in the upper and lower right-hand corners (as viewed from the back of the doors) and these hinges each hinge about a hinge-pin, such as 48, suitably mounted on the horizontal-bracing members such as 43. Each moulding has four projecting legs perpendicular to the rear face of the door, the legs being so shaped that they provide for a snap-on action when the door is being placed in position, the four legs embracing the hinge-pin. This snap-on action enables the doors to be readily removed when required. The door catch assembly 49 is of the well-known spring-latch type and is secured to a mounting plate which is positioned and held with a single screw secured to a plastics moulded handle 50, in a central position towards the right-hand edge of the door (as viewed from the front of the door). Small blocks, such

as 51, on the upper and lower faces of the horizontal bracing-members, such as 43, serve to prevent the door swinging into the cable-duct.

The "kicking-strip" 52 (Fig. 1, Fig. 4 and Fig. 5) which skirts a suite of racks is manufactured mainly from synthetic rubber i.e. Neoprene, or like resilient material and is mounted on the lower steel cover-plate 53. Fig. 5 illustrates a sectioned view of the cover-plate 53 and "kicking-strip" 52 and it should be appreciated that at suitably spaced intervals along the length of the cover-plate 53, towards the upper and lower edges, pressed and formed lugs, such as 54, project outwardly from the coverplate. The "kicking strip" has besides the three ribs 55, two inwardly directed lips, such as 56, at its edges and these hook behind the lugs such as 54. An addition to the "kicking strip" is the semi-circular plastics extrusion 57 which is slid on to the projecting T-sectioned portion positioned towards the upper frontal region of the "kicking strip" 52. This plastic extrusion 57, besides serving as a guard rail, also serves to improve the appearance of the "kicking strip", and incorporates a lengthwise strip of tin-foil embedded in the plastics material for this purpose.

Referring again to Fig. 1, it will be observed that towards the lower region of each of the uprights 15 and 18 there is a bearing-block such as 58. A similar block is positioned towards the lower region of each of uprights 16 and 17. Those bearing blocks are secured in the usual manner to the uprights with a T-bolt and nut, being pre-positioned by two locating pips (not shown) in the slot such as 22 (Fig. 3). The T-bolt passes through the open-ended slot 59 into the T-slot such as 21. Each bearing block has a bore such as 60 for taking a bearing-pin which is normally mounted to the rear of the "kicking strip" and frontal cover-plate at the base of the equipment-shelf area. By these means the "kicking strip" and frontal cover-plate can be tilted downwards to gain access to the rear of the cover-plate upon which is located a fuse-panel (not shown). Also in Fig. 1 there is shown a right-angled flange 61 which is used together with two other similar flanges, to secure the inter-rack cover-plates such as 53 to the base die-casting 10. The bolts used with the flanges are not shown but open-ended slots in the flange, and tapped bore in the base casting, are shown. It will be noticed that the uppermost and lowermost horizontal bracing-members such as 25 each have projecting below them the dust-covers such as 62. These covers are secured to the W-panels 30 and 31, and provide a lip which in conjunction with ledge 37a on the cross-rails such as 37 (Fig. 3) support the dust trays (not shown) pro-

vided below and above the equipment-shelf area.

The cable trunking mounted above the racking is of conventional form and is constructed similarly to that shown in British Patent Specification No. 938,688. However, in the present design, the trunking is bolted to a channel member (not shown) which is then secured to the gusset members such as 63 and 64; bores such as 65 are provided in the gusset members for locating the securing nuts and bolts. The gusset members 63 and 64 have open-ended slots, such as 66, at each end and are secured to the uprights in the usual manner with T-bolts and nuts.

The voltage-supply bus-bars run, in parallel-spaced-relationship, along the full length of the racking at its base. The details for securing these bus-bars are shown in Fig. 2. Three bus-bars 67, 68 and 69 pass through upper and lower plastics saddle-insulators such as 70 and 71 respectively. The lower saddle-insulator of each bus-bar rests in a slot such as 72 in the upstanding block such as 73, which is part of the die-casting, and a rigid metal strap, such as 74, bridges the upper saddle-insulators. The ends of the rigid metal-strap are secured with cheese-head screws, such as 75, to the upstanding block such as 73. It will be noted that each saddle insulators incorporates a slot having two widths. This is to enable the insulators to be used both for the thicker outer bus-bars 67 and 69 and the thinner central bus-bars 68.

The horizontal extruded cross-rails, such as 37, which bridge from one inter-rack space to another are shown in Fig. 3, Fig. 6, and Fig. 7. However, it is only in Fig. 6 that the purpose of having a detachable extruded section, such as 76, becomes apparent. It will be seen clearly from Fig. 3, that the end of the cross-rail such as 37 abuts the face of the horizontal bracing-member, such as 25. The end of the cross-rails such as 37 is designated 77 in Fig. 6. Now, in order that a pleasant appearance should be presented at the face of the racking, the end face of the extruded section 76 must abut the extruded upright to which the cross-rail 37 is at right angles. It will be obvious that to achieve this with the cross-rail and extruded section 76 as a unitary extrusion, could involve an undesirably time-consuming machining operation. The machining operation is avoided by incorporating two separate extrusions such as 37 and 76 which interlock. The interlocking arrangements involve a longitudinal key-hole slot in the extrusion 37 and corresponding sectioned portion on the extrusion 76 which slides into the extrusion 37.

Consequent upon the interlocking of extrusions 37 and 76 two U-shaped channels such as 78 and 79 are formed which accommodate the lower edge of one equipment-shelf trans-

parent cover, such as 80, and the upper edge of another equipment-shelf transparent cover respectively. This can be seen in Fig. 7 where the upper-edge of the lower cover of the three covers shown, is located into the lower channel of the centre extrusions 37 and 76, whereas the lower edge of the middle cover is located in the upper channel of the centre extrusions 37 and 76. Each transparent cover, such as 80, is a transparent plastics, e.g. the material known under the Registered Trade Mark Perspex, and has two plastics handles, such as 81, each of which is suitably positioned on the front of the cover, and secured by a screw, such as 82. The handles are prevented from rotating by the two studs such as 83 on the handle which locate into corresponding bores in the cover 80.

It is opportune at this juncture to consider the measures taken to prevent ingress of moisture and dust into the equipment-shelf area by way of the doors. In Fig. 3 it will be seen that each extruded upright has a longitudinal dovetail slot such as 84 in which is wedged, along its full length, a synthetic-rubber, scaling-strip 85. The doors such as 80, when fitted, as shown in the lower and middle door of the three covers shown in Fig. 7, are sealed on the rear face towards the left-hand and right-hand vertical edges by the now compressed-scaling strip 85. By virtue of being compressed the sealing strip 85 exerts an outwardly directed pressure on the cover which tends to push it outwardly. This has the effect of sealing the upper and lower horizontal edges of the cover, as a result of its outer face being pressed against the inner walls of the U-shaped channels, such as 78 and 79 (Fig. 6). Additional security is provided on the lower edge of the cover against ingress of moisture and dust, by the extreme edge of the cover abutting the root of the U-shaped channel such as 78.

The normal operations for fitting a cover in position require the upper edge to be inserted into the U-shaped channel such as 79 (Fig. 6) firstly, and secondly the lower face moved to abut the rear face of the U-shaped channel, such as 78, and thirdly the cover is moved downwardly so that its lower edge seats in the root of the U-shaped channel such as 78 (Fig. 6). Conversely a cover is removed by firstly lifting it upwardly, secondly moving its lower face away from the inner face of the U-shaped channel such as 78, and thirdly removing the upper edge from the U-shaped channel such as 79. A cover may be swung downwardly as shown in Fig. 7 and is suspended as shown by two plastics straps such as 86 one end of which has a bifurcating snap-in projection 87 (Fig. 6) which locates in the T-slot 88 in the extruded cross-rail such as 37. A plastics pin such as 89 which passes through the cover,

has a narrow shank terminating in a conical head, the base dimension of which is a little larger than the diameter of the shank of the pin. The other end of the strap has a circular aperture which is somewhat smaller than the base dimension of the conical tip, but slightly larger than the diameter of the shank of the pin. Thus, when the aperture is placed over the conical tip and then pressed over it the strap is secured to the cover.

There is an alternative arrangement for supporting a cover, such as 80, when it is not in its normal location, and this arrangement requires a different design of handle to be incorporated in place of that shown in Fig. 6 and Fig. 7 and designated 81. The design of the alternative handle is shown in the front elevation and side elevation of Fig. 8, two such handles being provided on each cover. In the front elevation it will be observed that a frontal plate 90 of the handle is heart-shaped, and it will be observed from the side elevation that a perpendicular post 91 extends from the plate 90 through the cover 80 to terminate upon a disc-like plate 92. It will be noticed from Fig. 9 that two spaces are remaining between a) the rear face of the frontal plate 90 and the front face of the door 80 and b) the rear face of the cover 80 and the front face of the disc like plate 92.

When a cover is removed from its normal location it can now rest towards the front of any other conveniently fixed cover by arranging that the posts 91 of the removed cover rest in the "V" 93 of the heart-shaped front plate 90 of the conveniently located fixed cover, and the disc like plates 92 of the removed cover rest in the space behind the front plates 90 of the fixed cover. This will be clearly apparent by referring to Fig. 9 where there is shown two handles interlocking as described.

The handles on the doors 45 and 46 can also take the form shown in Fig. 8.

Portions of racking not shown, for instance, the miscellaneous equipment units section mounted at the end of a suite of racks, is constructed on similar lines to those described.

WHAT WE CLAIM IS:—

1. A rack-mounting arrangement for electrical apparatus comprising a plurality of racks connected together in side-by-side relationship to form a suite, with the side walls of each rack forming an equipment mounting zone therebetween in which is located at least one equipment shelf, the inter-rack space between the side walls of adjacent racks serving as an enclosed cabling and wiring duct, wherein the inter-rack space comprises a die-cast base to which four extruded uprights are secured one at each corner of said base and the uprights are provided with a plurality of longitudinal T-shaped slots in each

of two opposite faces thereof, the T-shaped slots in one face of the uprights enabling the uprights to be secured by means of T-bolts to securing blocks on said base and also enabling spaced horizontal die-cast bracing members to be secured to opposite pairs of uprights to define the front and rear of the inter-rack space whereas the T-shaped slots in the other face of the uprights enable other die-cast bracing members to be secured to the other opposite pairs of uprights to define the sides of the inter-rack space, and one side each of two adjacent racks.

2. A rack-mounting arrangement as claimed in claim 1, wherein extruded cross-rails are secured between the bracing members defining facing sides of adjacent inter-rack spaces, the cross-rails each being provided with a longitudinal T-shaped slot to enable it to be secured between the bracing members by T-bolts engaging brackets on the bracing members.

3. A rack-mounting arrangement as claimed in claim 2, wherein said extruded cross-rails are provided on the opposite face to that having the T-shaped slot with a keyhole slot for the reception of an extruded section which is shaped to provide two opposed U-shaped channels one of which receives the lower edge of a transparent cover for one equipment shelf whereas the other receives the upper edge of a transparent cover of the equipment shelf immediately below said one equipment shelf.

4. A rack-mounting arrangement as claimed in claim 3, wherein straps of plastics material have one of their ends secured to a transparent cover towards the lower edge thereof and the other of their ends provided with a bifurcated snap-in member which locates with the T-shaped slot in the cross-rail, the length of the straps being such that the cover can be lifted out of the channels by which it is held and rotated outwardly and downwardly about its lower edge to hang in front of the cover of the next lower equipment shelf.

5. A rack-mounting arrangement as claimed in claim 3, wherein the transparent covers are each provided with two handles having a heart-shaped configuration with the "V" portion uppermost, the handle being mounted on a post which extends through the cover and is terminated by a circular plate whereby when the cover is removed it can be positioned on the front face of any other cover with the posts resting within the "V" portion of the handles of said other cover and with the plates resting between the handles of said other cover and the front face of said other cover.

6. A rack-mounting arrangement as claimed in claim 1, wherein said other bracing members are prepositioned by means of location ribs which locate in the T-shaped slots in said other face of the uprights.

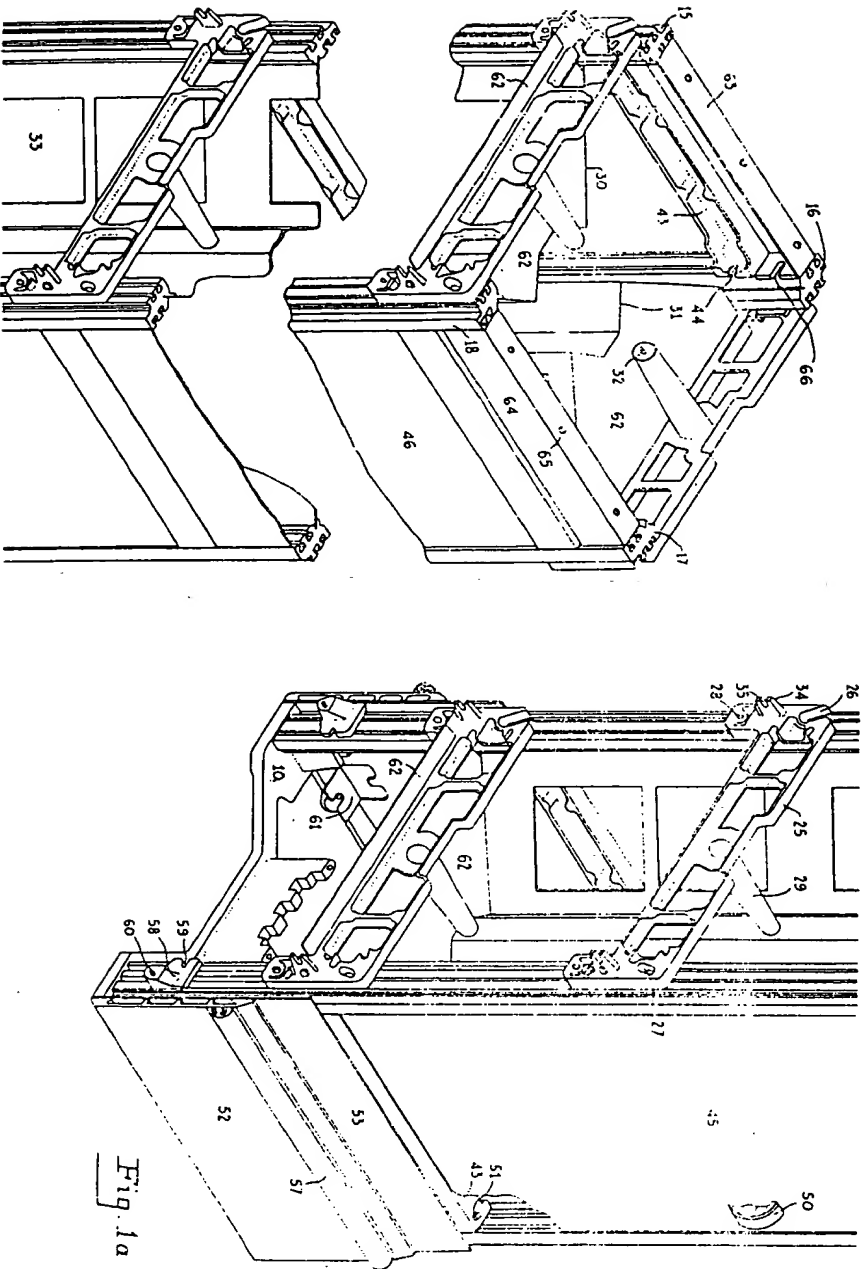
7. A rack-mounting arrangement as claimed in claim 1, wherein the extruded uprights are also provided with longitudinal slots for receiving a W-shaped cross-section wall extending between a pair of uprights and forming one partition within an inter-rack space, the W-shaped wall abutting against and being secured to a longitudinal flange provided on the extruded uprights.
8. A rack-mounting arrangement as claimed in claim 7, wherein the die-cast bracing members defining the sides of the inter-rack space are each provided with a post extending into the inter-rack space and serving as an additional support for the W-shaped wall extending between the pair of uprights to which the bracing members are secured.
9. A rack-mounting arrangement as claimed in claim 7, wherein the uppermost and lowermost of the die-cast bracing members defining the sides of the inter-rack space are provided with dust-covers extending inwardly towards and secured to the W-shaped walls and extending outwardly to form a lip which in conjunction with lips on the cross-rails serve to support dust trays which enclose the spaces for the equipment shelves.
10. A rack-mounting arrangement as claimed in claim 1, wherein the bracing members defining the facing sides of adjacent inter-rack spaces are each provided with two bearing housings arranged to take the bearing pin of a hinged equipment shelf frame.
11. A rack mounting arrangement as claimed in claim 1, wherein hinged doors are provided in the space between adjacent bracing members defining the front and rear of the inter-rack space.
12. A rack-mounting arrangement as claimed in claim 2, wherein the space below the lowermost cross-rails is closed by a downwardly hinging cover plate.
13. A rack-mounting arrangement as claimed in claim 12, wherein bearing blocks are secured by means of T-bolts in the T-shaped slots in said other face of the uprights.
14. A rack-mounting arrangement as claimed in claim 12 or 13, wherein the cover plate is provided with a kicking strip made of resilient material.
15. A rack-mounting arrangement as claimed in claim 14, wherein at spaced intervals along the cover plate there are provided towards the upper and lower edges pressed and formed lugs and the kicking strip is provided with two inwardly directed lips arranged to engage the lugs thereby securing the kicking strip to the cover plate, a semi-circular length of extruded plastics material being slid on to a T-sectioned portion located towards the upper edge of the kicking strip.
16. A rack-mounting arrangement for electrical apparatus substantially as described with reference to the accompanying drawings.

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Reference has been directed in pursuance of Section 9, subsection (1) of the Patents Act, 1949, to patent No. 938,688.

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 6 SHEETS This drawing is a reproduction of
 the Original on a reduced scale
 Sheets 1 & 2

Fig. 1



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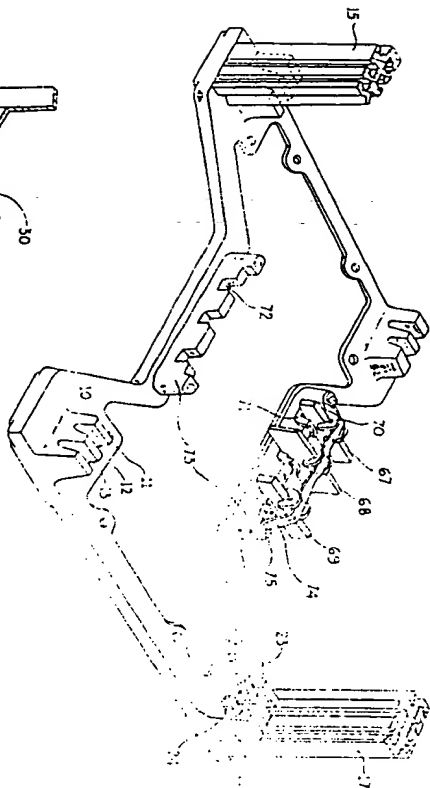


Fig. 2

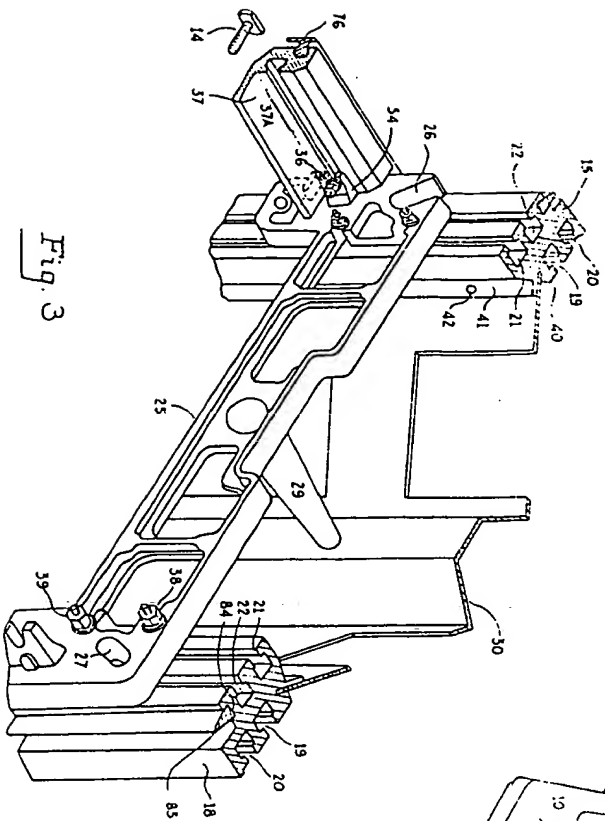
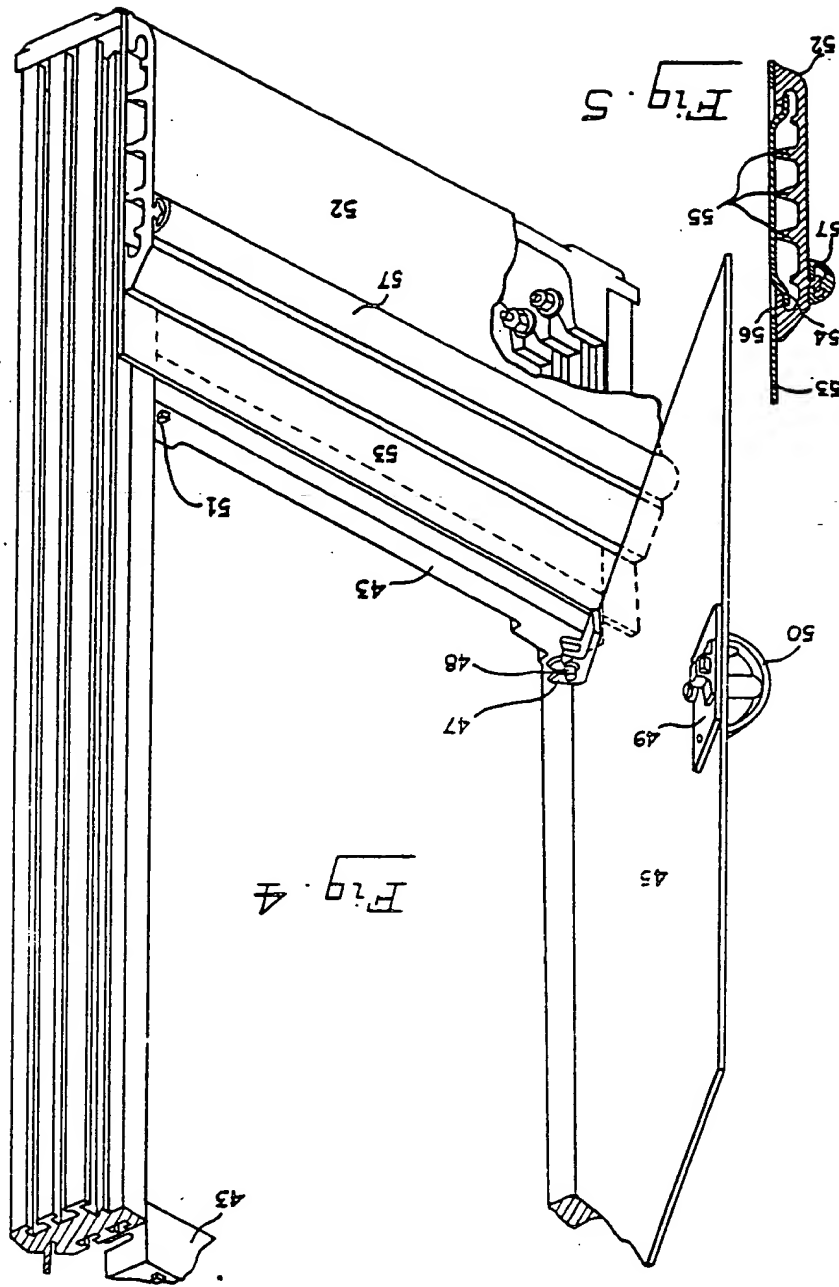
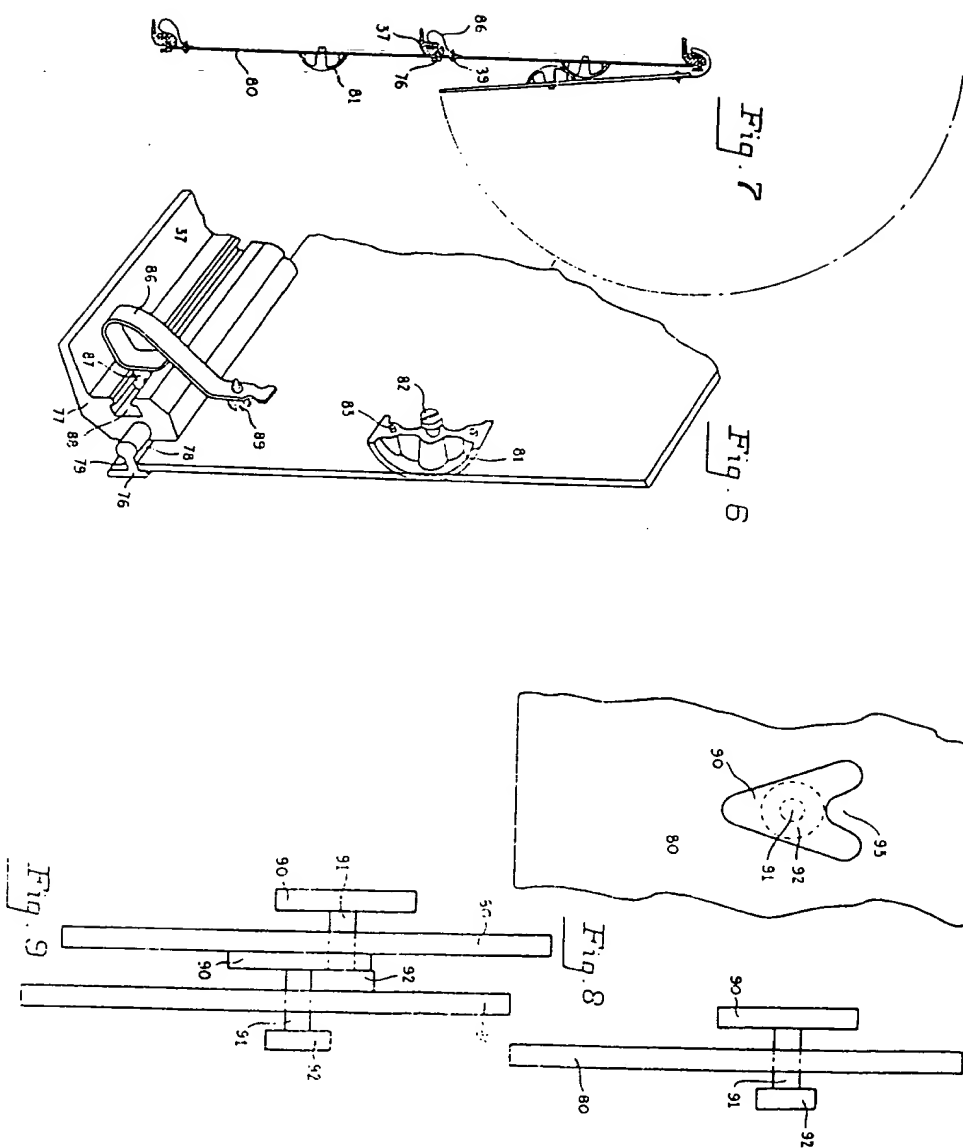


Fig. 3

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